

ORIGINAL

ORIGINAL

LAW OFFICES  
LEVENTHAL, SENTER & LERMAN P.L.L.C.

NORMAN P. LEVENTHAL  
MEREDITH S. SENTER, JR.  
STEVEN ALMAN LERMAN  
RAUL R. RODRIGUEZ  
DENNIS P. CORBETT  
BRIAN M. MADDEN  
BARBARA K. CARDNER  
STEPHEN D. BARUCH  
SALLY A. BUCKMAN  
NANCY L. WOLF  
DAVID S. KEIR  
DEBORAH R. COLEMAN  
NANCY A. ORY  
WALTER P. JACOB  
ROSS G. GREENBERG  
H. ANTHONY LEHV  
JOHN D. POUTASSE  
CHRISTOPHER J. SOVA  
PHILIP A. BONOMO  
JUAN F. MADRID

OF COUNSEL  
MARLA R. WOLFE

SUITE 600  
2000 K STREET, N.W.  
WASHINGTON, D.C. 20006-1809

TELEPHONE  
(202) 429-8970

TELECOPIER  
(202) 293-7783

November 10, 1999

WWW.LSL-LAW.COM

EX PARTE OR LATE FILED

RECEIVED  
NOV 10 1999  
FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

WRITER'S DIRECT DIAL  
202-416-6782

WRITER'S DIRECT FAX  
202-429-4626

WRITER'S E-MAIL  
SBARUCH@LSL-LAW.COM

**VIA HAND DELIVERY**

Ms. Magalie Romas Salas  
Secretary  
Federal Communications Commission  
The Portals  
445 12th Street, S.W.  
Washington, D.C. 20554

Re: **Notification of Ex Parte Presentation in**  
**File No. SAT-LOA-19990108-00007, ET Docket No. 98-206/**

Dear Ms. Salas:

On November 10, 1999, representatives of Virtual Geosatellite, L.L.C. ("Virtual Geo") met with Julius P. Knapp, Geraldine A. Matise, Thomas Derenge, and Bruno Patan from the Commission's Office of Engineering and Technology on matters pertaining to Virtual Geo's above-referenced application and the above-referenced rulemaking proceeding. Representatives of Virtual Geo included Gerald Helman, Jay Brosius, Richard Barnett, Raul Rodriguez, and the undersigned.

Virtual Geo's presentation concerned the manner in which the proposed Virtual Geo satellite system, known as "Virgo," would utilize fixed-satellite service spectrum on a shared basis with geostationary, non-geostationary, and terrestrial systems. Virtual Geo also discussed related matters pertaining to the policy decisions to be taken in the Commission's Ku-band rulemaking proceeding in ET Docket No. 98-206, along with associated matters relating to

131249

No. of Copies rec'd 04  
List ABCDE

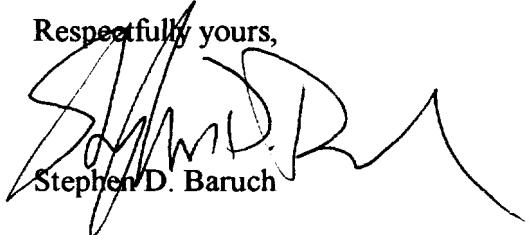
LEVENTHAL, SENTER & LERMAN P.L.L.C.

Ms. Magalie Romas Salas  
November 10, 1999  
Page -2 -

Virtual Geo's pending petition for rule making concerning use of C-band spectrum for non-geostationary fixed-satellite service systems. The presentation of which copies are attached hereto was given at this meeting.

Please contact me if there are any questions.

Respectfully yours,

A handwritten signature in black ink, appearing to read "Stephen D. Baruch".

Stephen D. Baruch

Enclosure

cc (w/encl.): Julius P. Knapp  
Geraldine A. Matise  
Thomas Derenge  
Bruno Patan

# NGSO/Virgo Operation in FSS C-Band Allocations

November 1999

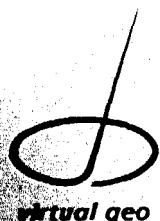
# Virtual Geo Requests C-band Spectrum for Virgo

- Virgo's architecture opens a new opportunity to re-use C-band FSS spectrum on a non-interfering basis
  - Virgo's Geometry effectively eliminates interference to C-band GSO satellites
  - High elevation angles minimize interference to terrestrial services
  - Therefore opens additional (virtual) north and south GSO arcs
  - FSS spectrum is freely re-usable in these new arcs
  - Virtual Geo groundtracks create a new virtual GSO assignment/allocation resource

# Virgo

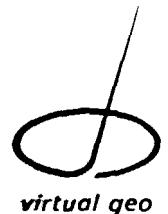
- A global space-based networking and internet access service
- Using a patented\* NGSO elliptical constellation of satellites
  - to optimize coverage of continental land masses, and
  - to minimize interference to other services in the band
- Supports:
  - High speed, multi-megabit per second digital traffic and applications
  - Modest sized user terminals (18" antennas)
  - Locations anywhere on the Globe

\*patent no's 5,845,206; 5,957,409; and others pending



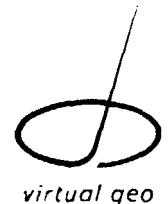
# Unique Features

- Avoids assignment and coordination complications by reusing FSS spectrum well below existing or proposed interference criteria
- Optimizes service over continental land masses
- Provides pole to pole global coverage
- Location-independent high speed digital access

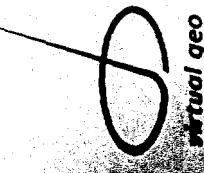
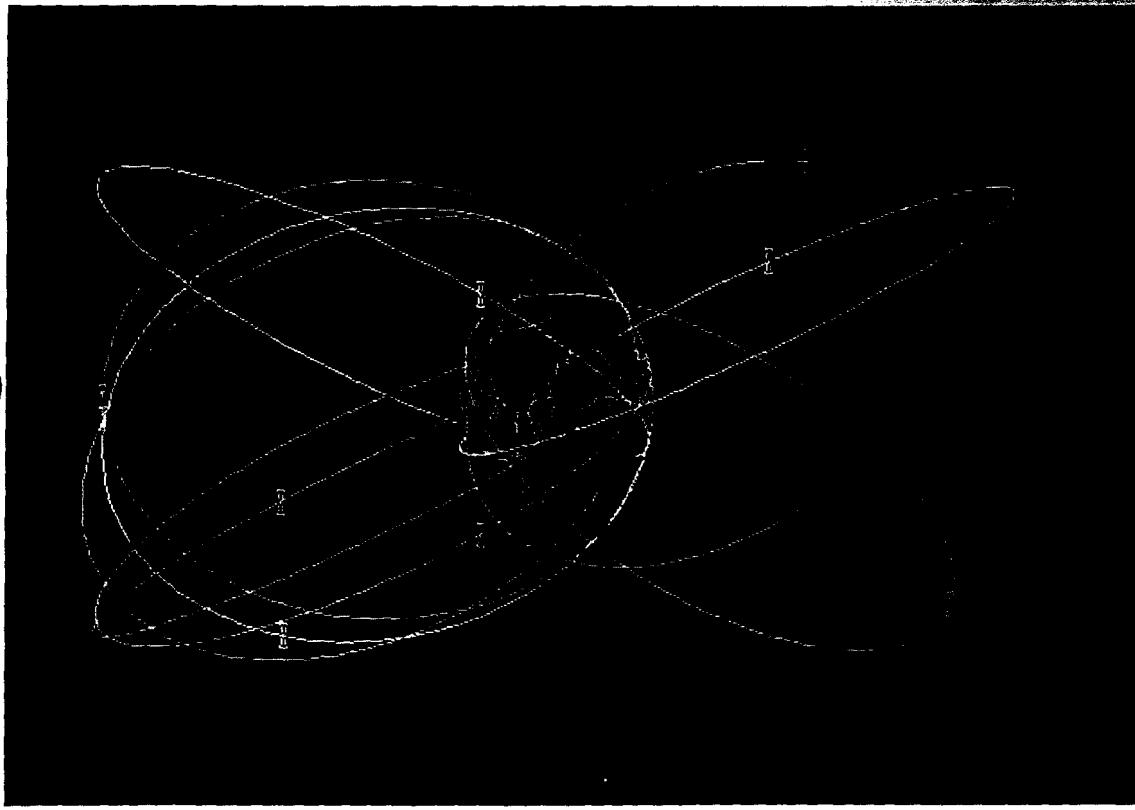


# Orbits

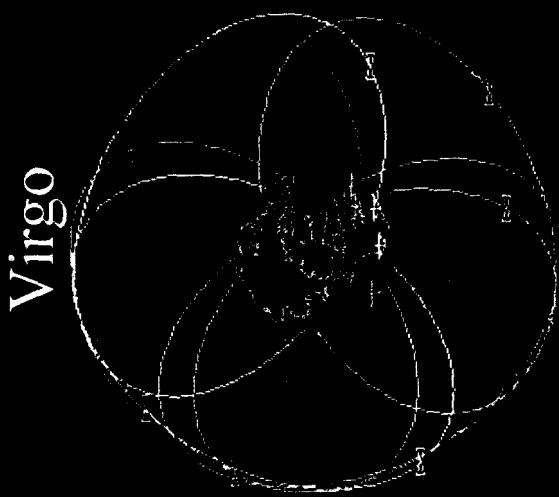
- General
  - 15 Satellites:
  - 3 ground tracks of 5 each
  - Spares
    - One available to each ground track
  - 8 hour elliptical, critically inclined orbits, 1 plane per satellite



# The Virgo OrbitS



# Virgo from the North



GEO

virtual geo

# The Virgo Active Arcs



10  
10-Nov-99

Virtual Geostatellite, LLC - Proprietary Information

Virtual geo

# Virgo User Terminal Frequencies

	Frequencies	Bandwidth Available
<b>Uplink</b>	<b>14.0 – 14.5 GHz</b>	<b>500 MHz each polarization 1,000 MHz total</b>
<b>Downlink</b>	<b>11.2 – 12.7 GHz</b>	<b>1,500 MHz each polarization 3,000 MHz total</b>

# User Terminal Spectrum Use Traffic Links

- **Uplink**

- 1,000 MHz total available
- Each beam allocated 250 MHz in one polarization
- This is one-quarter of total uplink spectrum available

- **Downlink**

- 3,000 MHz total available
- Each beam allocated 750 MHz
- This is one-quarter of total downlink spectrum available
- 500 MHz used for Single Beam service
- 250 MHz used for Multi-beam broadcast reception

# Virgo Gateway Frequencies

	<b>Frequencies</b>	<b>Bandwidth Available</b>
<b>Uplink</b>	<b>5.925 – 6.725 GHz</b>	2,000 MHz each polarization 4,000 MHz total
	<b>12.75 – 13.25</b>	
	<b>13.8 – 14.0</b>	
	<b>17.3 – 17.8</b>	
<b>Downlink</b>	<b>10.7 – 11.2</b>	1,000 MHz each polarization 2,000 MHz total
	<b>3.7 – 4.2</b>	

# Virgo Gateway Frequency Use

- 4 Gateway beams per satellite (i.e., per region) each serving a Gateway
- Asymmetric: Download spectrum is 2 times upload spectrum

# Virgo Frequency Re-use

- **Feeder Link**

- 8 times per satellite
  - 4 beams
  - 1 in 1 frequency spatial reuse
  - 1 in 2 polarization reuse
- 72 times over system (9 arcs times 8 per arc)

# Virgo and C-band Interference

28  
10-Nov-99

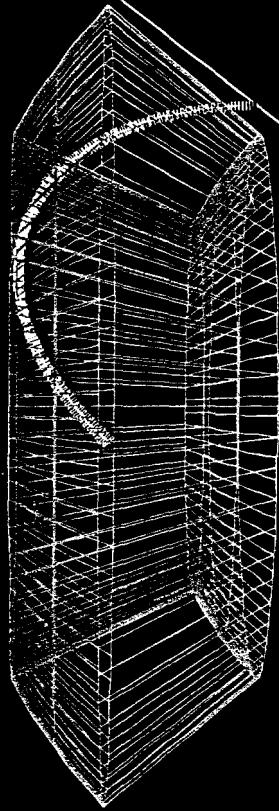
*Virtual Geostar LLC - Proprietary Information*



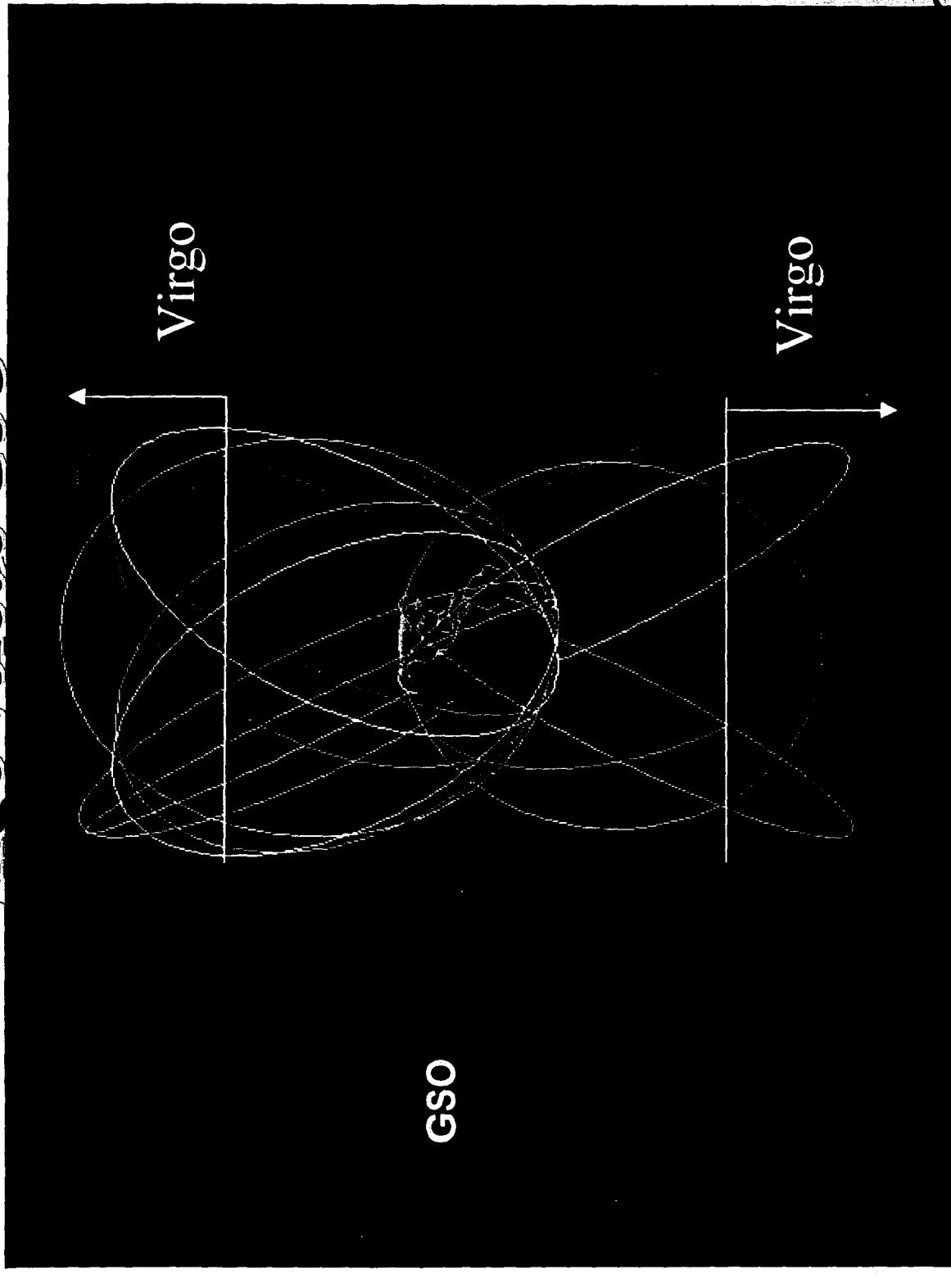
*virtual geo*

# Comparison of Virgo and GSO

## Operating Regions

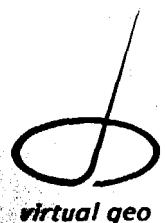


# Virgo versus GSO



# Geostationary Arc Separation

- Actually always more than 45 degrees
- Guarantee always more than 40 degrees
- Lowest for terminals at far North and far South latitudes
- Always >50 degrees in CONUS



# Relative GSO Arc Protection Factors

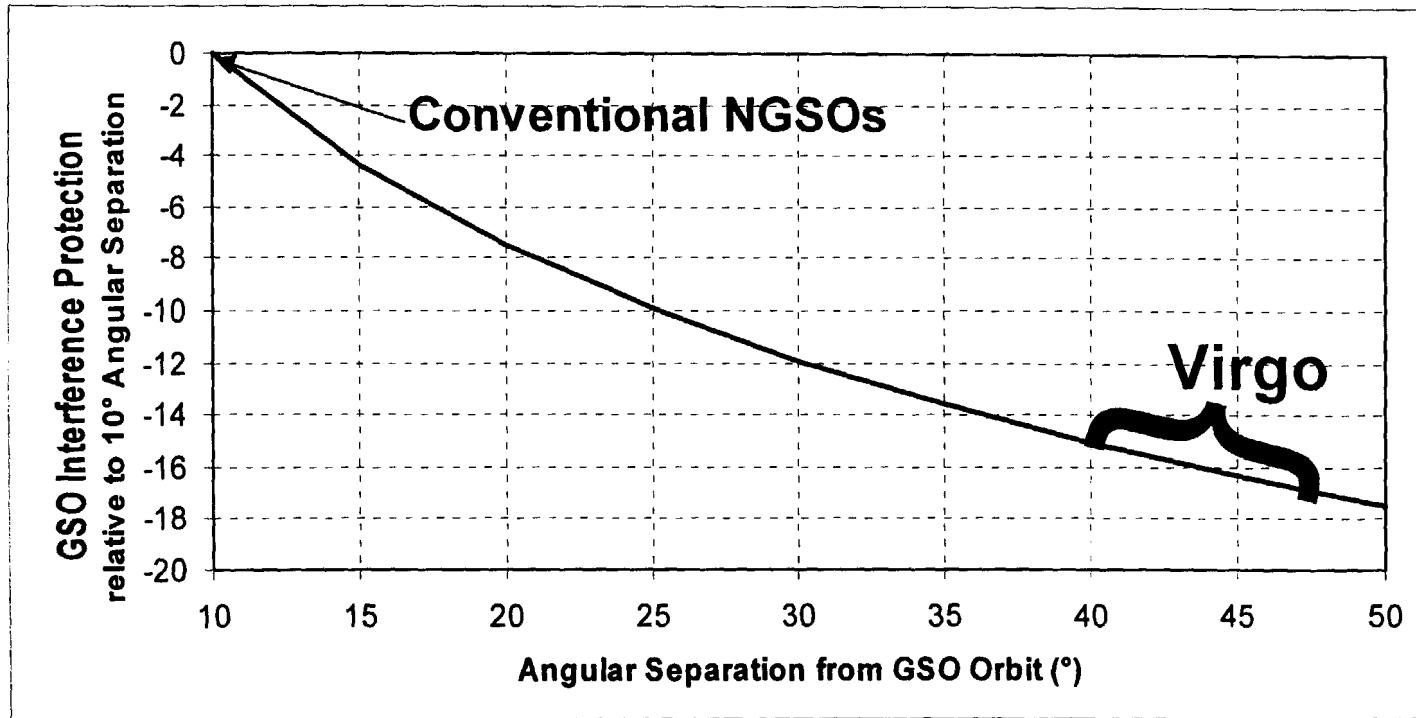


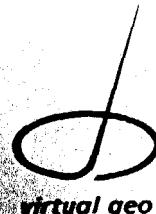
Chart based upon  $25\log\Theta$  rolloff

# Interference to C-Band GSO Earth Station

## 3.7 - 4.2 Ghz

Maximum PFD of VIRGO™ satellite in 4 kHz	-165	dBW / m <sup>2</sup> / 4kHz
GSO orbit avoidance angle	40	°
GSO Rx Earth Station gain towards VIRGO™ satellite	-8.1	dBi
Frequency	4000	MHz
Effective Aperture of GSO Rx Earth Station towards VIRGO™ satellite	-41.5	dB-m <sup>2</sup>
GSO Rx Earth Station Interfering Signal Power in 4 kHz	-206.5	dBW / 4kHz
GSO Rx Earth Station Interfering Signal Power Spectral Density	-242.6	dBW / Hz
Increase in interference due to 3 simultaneously visible VIRGO™ satellites	4.8	dB
GSO Rx Earth Station Interfering Signal Power Spectral Density (3 VIRGO™ satellites)	-237.8	dBW / Hz
GSO Rx Earth Station System Noise Temperature	80	K
GSO Rx Earth Station System Noise Power Spectral Density	-209.6	dBW / Hz
I <sub>o</sub> /N <sub>0</sub> at GSO Rx Earth Station Input	-28.2	dB

ΔT/T Degradation to Earth Station      0.15%



# Interference to C-Band GSO Satellite Receiver

## 5.925 - 6.425 GHz

	Clear Sky	Rain	
<b>Maximum PSD into VIRGO™ Earth Station Antenna in 4 kHz</b>	-25.0	-21.8	dBW / 4kHz
<b>GSO orbit avoidance angle</b>	40	40	°
VIRGO™ Tx Earth Station gain towards GSO Satellite	-4.1	-4.1	dBi
VIRGO™ Tx Earth Station EIRP Spectral Density towards GSO Satellite in 4 kHz	-29.1	-25.9	dBW / 4kHz
PFD at the GSO Satellite in 4 kHz	-191.2	-188.0	dBW / m <sup>2</sup> / 4kHz
Frequency	6325	6325	MHz
<b>Assumed Gain of GSO Satellite Rx towards VIRGO™ Earth Station</b>	40	40	dBi
Effective Aperture of GSO Satellite Rx towards VIRGO™ Earth Station	2.5	2.5	dB-m <sup>2</sup>
GSO Satellite Rx Interfering Signal Power in 4 kHz	-188.6	-185.4	dBW / 4kHz
GSO Satellite Rx Interfering Signal Power Spectral Density (one VIRGO™ earth station)	-224.7	-221.5	dBW / Hz
GSO Satellite Rx Interfering Signal Power Spectral Density (two VIRGO™ earth stations)	-221.7	-218.5	dBW / Hz
GSO Satellite Rx System Noise Temperature	600	600	K
GSO Satellite Rx System Noise Power Spectral Density	-200.8	-200.8	dBW / Hz
I <sub>o</sub> /N <sub>o</sub> at GSO Satellite Rx Input	-20.8	-17.6	dB

$\Delta T/T$  Degradation to Satellite Receiver 0.82% (1.7% rain)



# -----

# Virgo Coverage and Protection to FS

- **Coverage optimized over land masses**

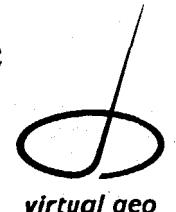
- |  | Improvement Factor* |
|--|---------------------|
| – US Coverage  |                     |
| • <i>Always &gt; 42 degrees in CONUS</i>   | 23 dB               |
| • <i>&gt;30 degrees for VI, PR</i>   | 19 dB               |
| • <i>&gt;35 degrees for Hawaii</i>   | 21 dB               |
| – Global Coverage: - Elevation Angles  |                     |
| • <i>Exceed 30 degrees for 50% of land areas</i>                                   | 19 dB               |
| • <i>Exceed 20 degrees for 90% of land areas</i>                                   | 15 dB               |
| • <i>Exceed 10 degrees for 99.9% of coverage area</i>                              | 8 dB                |
| – Lowest elevation angles occur off land over Atlantic, Indian, and Pacific Oceans |                     |

\* Relative to 5° minimum elevation angle

# NGSO-NGOS Interference

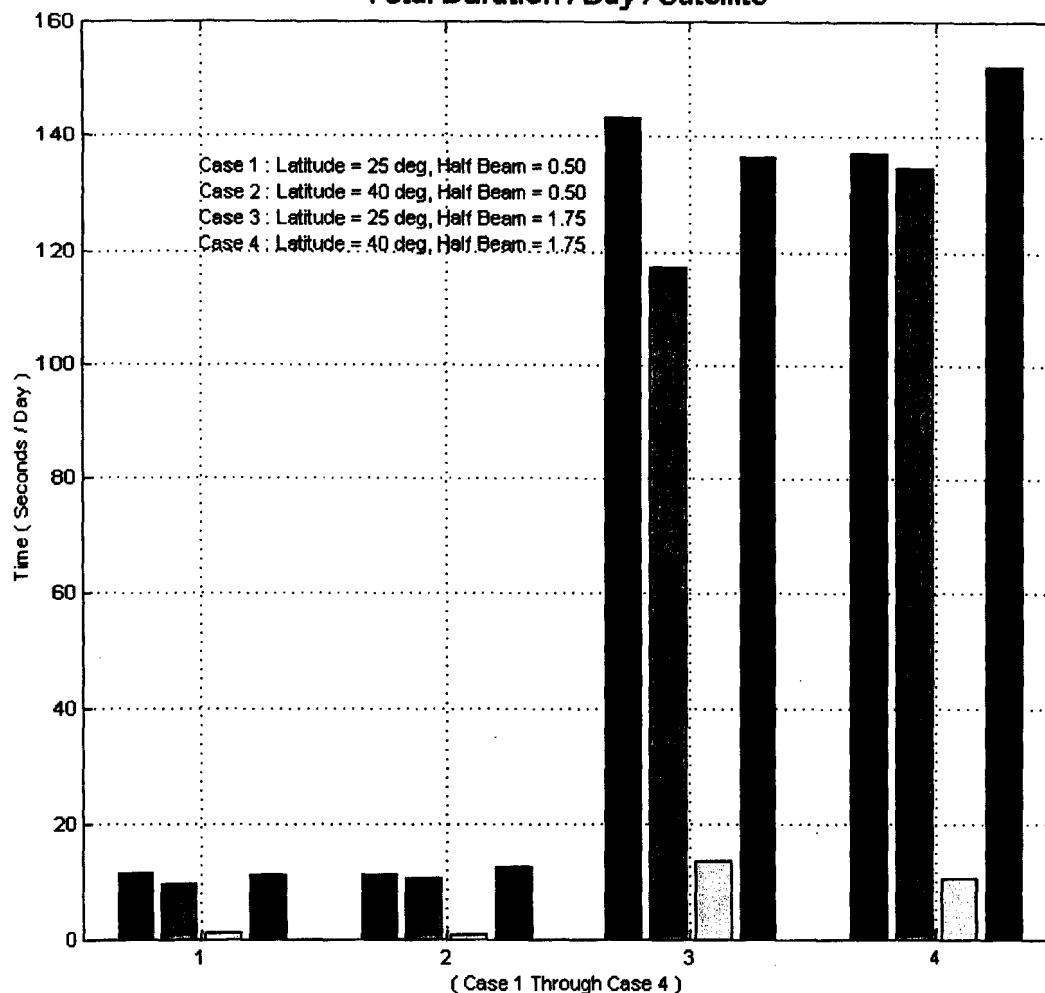
- Uncoordinated NGSO orbits frequently cross each other's tracks
- Crossing causes co-linear interference events
- Avoided by Uniform adoption of non-crossing orbit design
- Only elliptical, active arc type orbits (e.g. Virgo) feature
  - Global Coverage
  - Non-crossing active arcs
  - Excellent GSO separation

Satellites can be slot-assigned in V-GEO tracks just as in the GSO arc  
Scores, perhaps hundreds of new assignments are possible



# Competing System Interference on Virgo

Competing System Interference On Virgo  
Total Duration / Day / Satellite



# Summary

- Virgo uses new (virtual) GSO arcs featuring
  - No effective interference to GSO satellites or earth stations
  - Wide angular separation between satellites and FS services
  - The opportunity to reuse FSS spectrum in new GSO-like high-latitude arcs on a non-interfering basis
- Virtual Geosatellite therefore respectfully requests authority to use co-directional C-band FSS spectrum for feeder link purposes
- Virtual Geosatellite further urges the Commission to establish defined virtual geostationary arcs into which various virtual geostationary systems can deploy on slot assignment with reuse of C-band FSS spectrum

